Trade Shocks and Factor Adjustment Frictions: Implications for Investment and Labor

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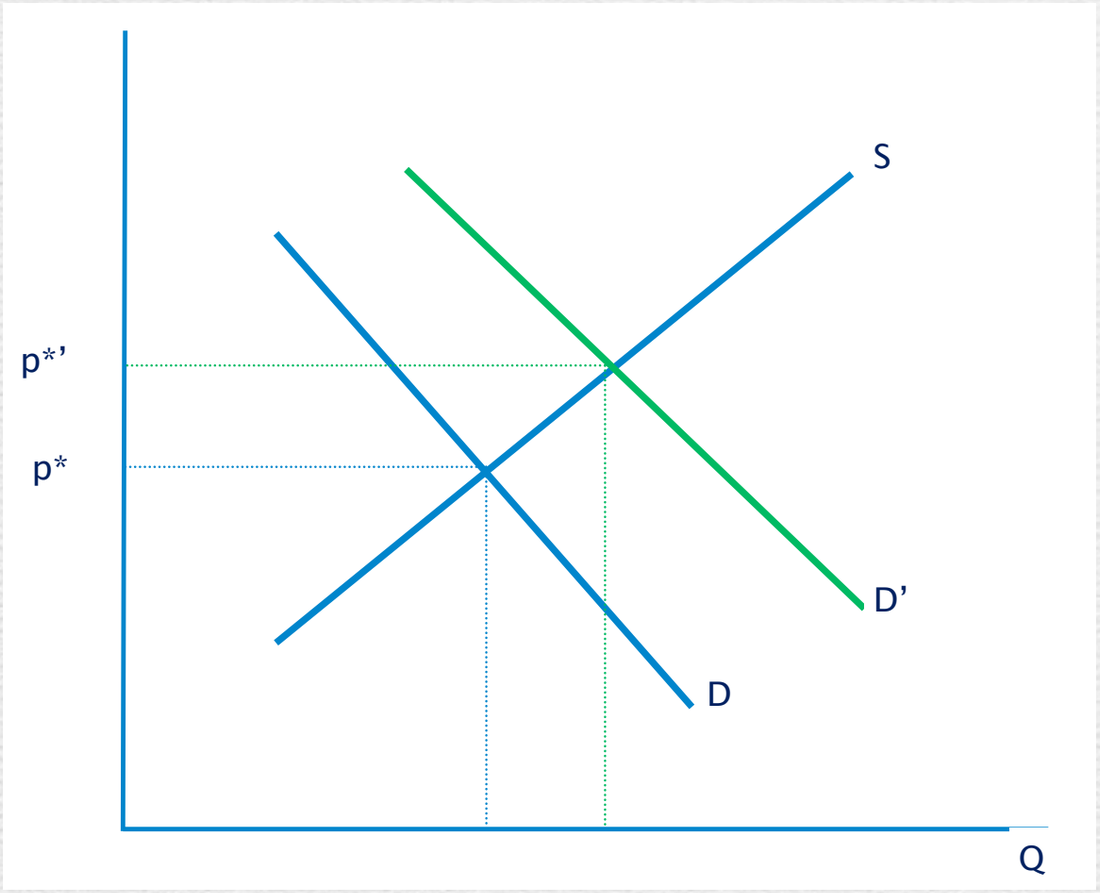
Globalization, Firms and Workers

- Trade Shock: Exogenous price change of a sector's output in a small open economy (Argentina)



Positive Trade Shock:

- Firms: increase capacity and invest
- Workers move to expanding sectors
- Firms' and workers' face adjustment frictions and their reactions depend on each other.

Trade Shocks and Labor Markets

- Workers face sectoral switching costs
- Artuc, Chaudhuri and McLaren (2010), Artuc and McLaren (2014), Kambourov (2009), Cosar, Guner and Tybout (2011), Dix-Carneiro (2012),...
- Adjustment costs determine:
    - The distributional effects (changes in wages, welfare, etc.)
    - The speed of adjustment and the dynamic increase in labor supply

Trade Shocks and Capital Adjustment

- Firms face capital adjustment costs (KAC) when they invest and increase capacity
- Cooper and Haltiwanger (2006), Bloom (2009), Rho and Rodrigue (2012),...
- Capital adjustment costs include:
    - Convex costs: smooth investment
    - Fixed costs: indivisibility, investment bursts
    - Irreversibility: low capital resale price

Trade Shocks and Factor Adjustment

- Interaction of factor market frictions
  - High labor adjustment costs → Smaller investment response after a trade shock
  - High capital adjustment costs → Smaller change in labor allocation after a trade shock
- Complementarity of trade policy and frictions
  - Labor and capital adjustment costs matter more when the economy receives a trade shock (Trade reform alone may be ineffective)

Outline

Model: Workers' optimization problem
(Workers dynamically choose sectors)

⇩

Model: Firms' optimization problem
(Firms decide how much to invest)

⇩

Estimation Strategy
(Pin down theoretical parameters)

⇩

Joint Solution & Simulations
(Interact firms' and workers' response to shocks)

Workers

- Continuum of identical, risk neutral, rational workers, with with Cobb-Douglas preferences
- Workers choose sectors $j \in \{1,2,...,J\}$
- Instantaneous utility of worker l in industry j

$$w_t^j + \eta^j$$

wage

fixed sectoral utility

Workers

- At the end of time t a worker can move to sector k at a cost

$$C^{jk} + \varepsilon^{k}_{lt}$$

<u>deterministic part</u>
positive for movers,
zero for stayers,
i.e. $C^{jk}=0$ if $j=k$

<u>random part</u>
iid extreme value
distributed (0,ν)

(only sectoral switching costs, will not deal with switching within sector)

Workers

- At the end of t a worker chooses her new sector optimally,
- Her maximized utility

$$\underbrace{\widetilde{W}^j(s_t, \varepsilon_{lt})}_{} = w_t^j + \eta^j + \max_k \{\beta E_t \underbrace{W^k(s_{t+1})}_{} - C^{jk} - \varepsilon_{lt}^k\}$$

value function

s_t: aggregate state

ε_{lt}: shock vector

value function,
next period,
with

$$W^k(s_{t+1}) = E_\varepsilon \widetilde{W}^k(s_{t+1}, \varepsilon)$$

Workers

- Aggregate state (information set)

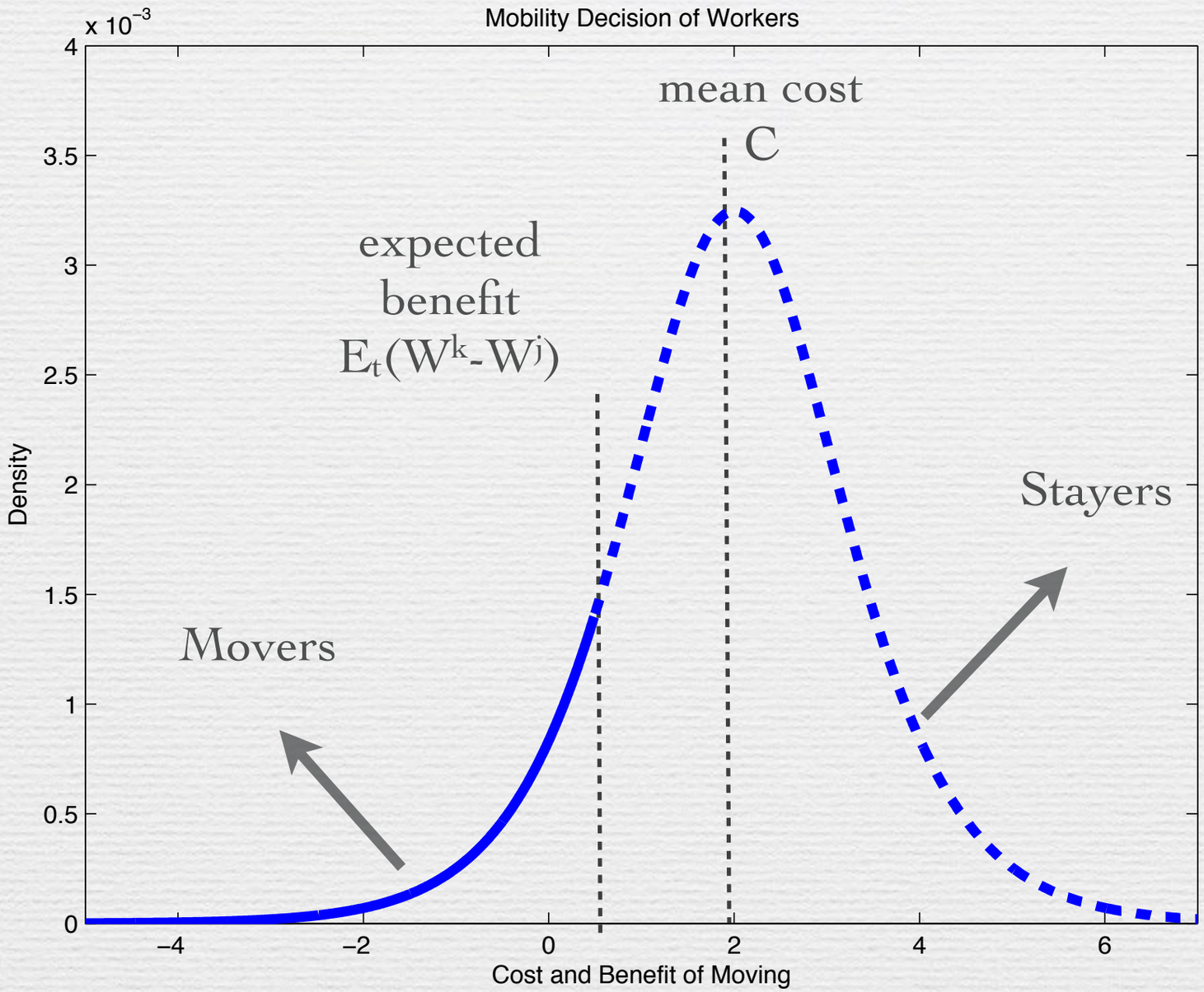
$$s_t = \{\mu_t,\ L_t,\ p_t\}$$

<u>distribution of firms</u>
3D array, dimensions:
sectors ×productivity ×capital

<u>labor allocation</u>
vector, J×1 elements

<u>prices</u>
vector, J×1 elements

Workers



- Workers' decisions characterize flow of workers, labor allocations, and sectoral labor supply

Firms

- *J* sectors, one non-tradable sector
- Cobb-Douglas production function with a Markov technology parameter, AR(1) with ρ and σ
- Firm *f* in sector *j* produces Q^j_{ft} units of output with K^j_{ft} units of capital and L^j_{ft} units of labor

$$Q^j_{ft} = A^j_{ft}(K^j_{ft})^{\alpha^j_k}(L^j_{ft})^{\alpha^j_l}$$

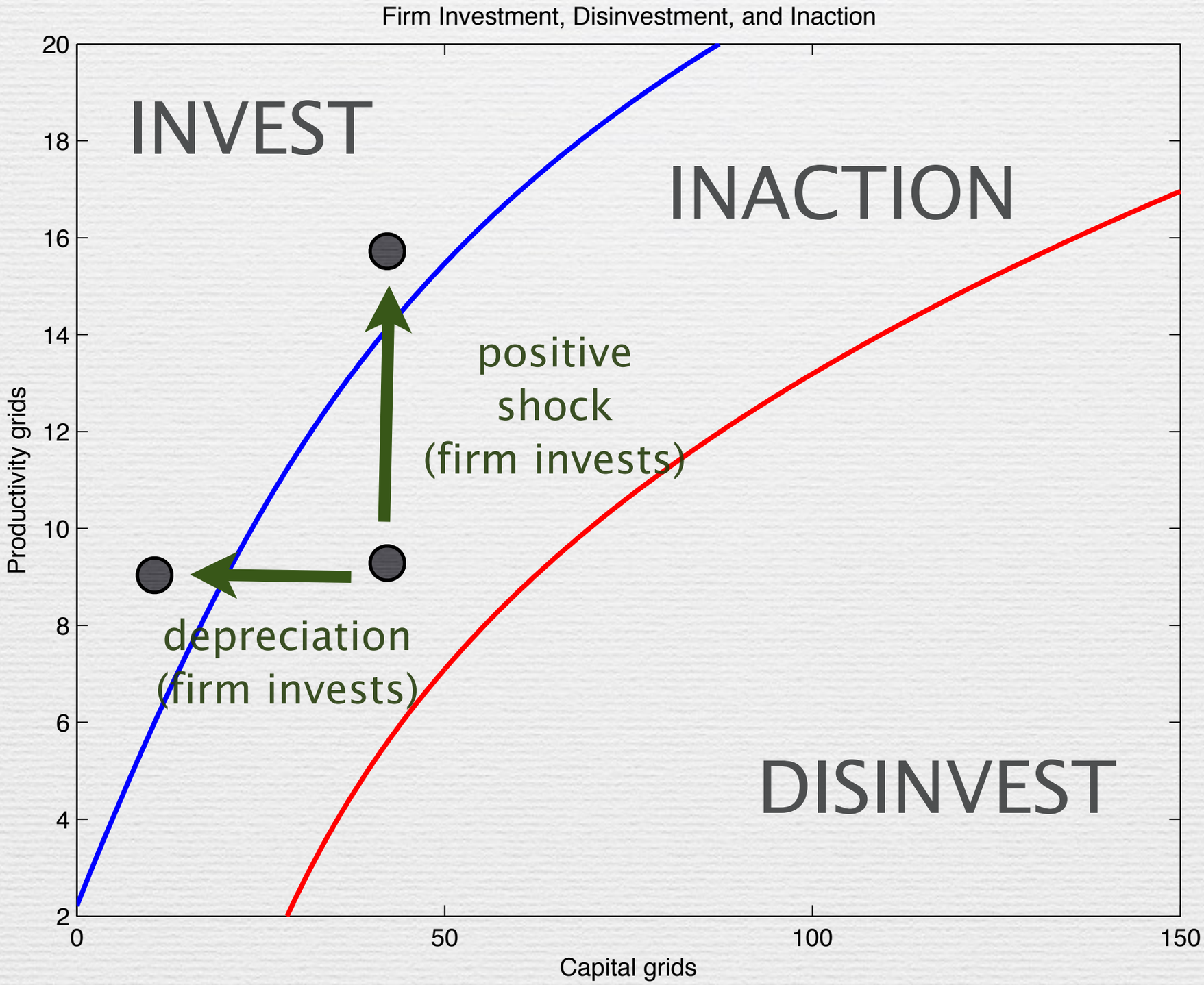
- Capital accumulation

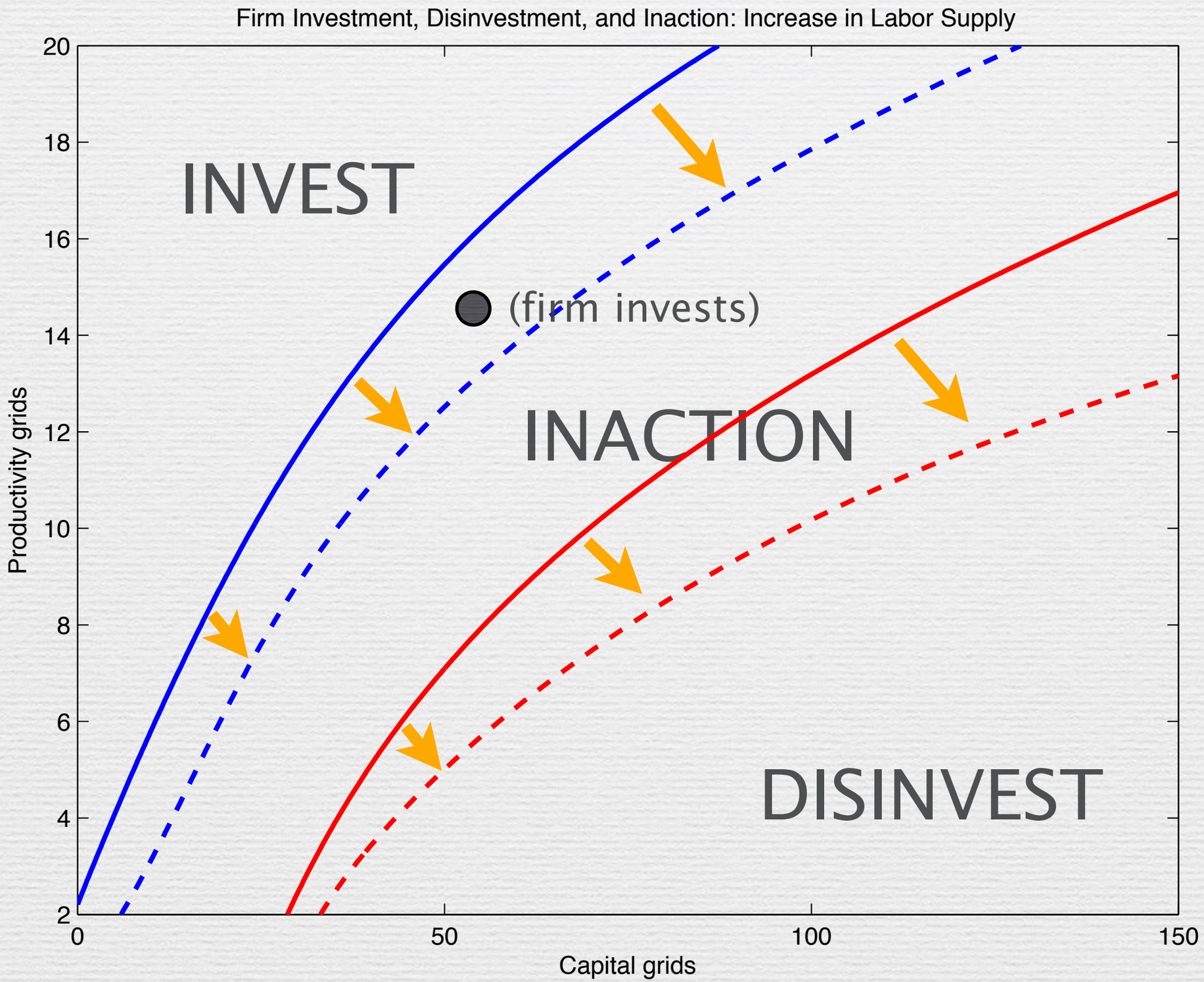
$$K^j_{f,t+1} = (1-\delta^j)K^j_{ft} + I^j_{ft}$$

Firms

- Capital adjustment costs a la Cooper and Haltiwanger (2006) and Bloom (2009)

$$G_{ft}^{j} = \begin{cases} F K_{ft}^{j} + \frac{\gamma}{2}(I_{ft}^{j}/K_{ft}^{j})^{2} K_{ft}^{j} + p_b I_{ft}^{j} & if \quad I_{ft}^{j} > 0 \\ 0 & if \quad I_{ft}^{j} = 0 \\ F K_{ft}^{j} + \frac{\gamma}{2}(I_{ft}^{j}/K_{ft}^{j})^{2} K_{ft}^{j} + p_s I_{ft}^{j} & if \quad I_{ft}^{j} < 0 \end{cases}$$


Firm Investment, Disinvestment, and Inaction
INVEST
INACTION
DISINVEST
positive
shock
(firm invests)
depreciation
(firm invests)
Productivity grids
Capital grids
20
18
16
14
12
10
8
6
4
2
0
50
100
150


Firm Investment, Disinvestment, and Inaction: Increase in Labor Supply
INVEST
(firm invests)
INACTION
DISINVEST
Productivity grids
Capital grids
20
18
16
14
12
10
8
6
4
2
0
50
100
150

Estimation (workers)

- Data: Household survey from Argentina (EPH), years 1996-2007
- Sectors: 1. Food and beverages, 2. Textiles and apparel, 3. Other manufacturing, 4. Non-metallic mineral, 5. Metal, and 6. Service
- Sectoral wage and number of workers switching between sector pairs
- Estimable parameters: C^{jk}, η^{j}, ν

Estimation (Workers): Results

Moving Friction Estimates			
	C^1	C^2	$1/\nu$
Coef	2.58***	1.57***	1.45**
Std.	*(0.82)*	*(0.69)*	*(0.61)*

Sectoral Premium Estimates						
η^j/ν						
	Food	Textile	Other	Mineral	Metal	Service
Coef	0	-0.365***	-0	-0.596***	-0.494***	0
Std.	---	*(0.06)*	*(0.3)*	*(0.13)*	*(0.18)*	*(0.15)*

Estimation (Firms)

- Panel of 568 plants from Argentina, 1994-2000
- Production technology, estimate α_l and α_k: Olley and Pakes (1996) and Levinsohn and Petrin (2003)
- Capital adjustment costs, estimate F, γ and p_s: SMM similar to Bloom (2009)
- SMM Moments: Correlation in investment, correlation between investment and productivity, percentage of firms investing above and below 20%

Estimation (Firms): Results

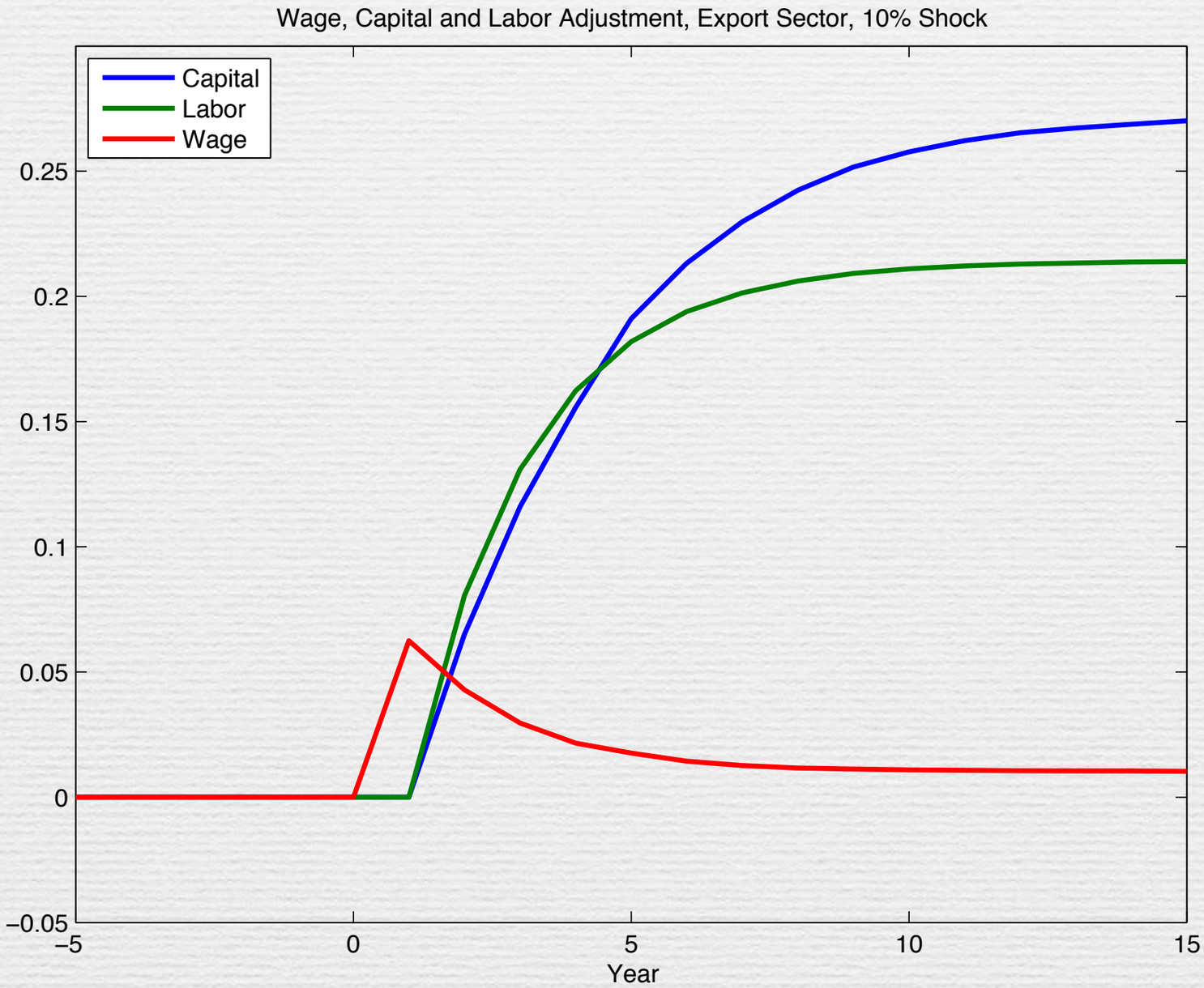
Production Function Parameters				
	Labor	Capital	Corr.	Std.
	α_l	α_k	ρ	σ
Manuf.	0.589****	0.142***	0.885	0.665
	(0.013)	*(0.042)*	-	-

Capital Adjustment Cost Parameters			
Fixed	Quad.	Resale	Depreciation
F	γ	p_s	δ
0.145***	0.113***	0.914***	0.099
(0.04)	*(0.011)*	*(0.073)*	-

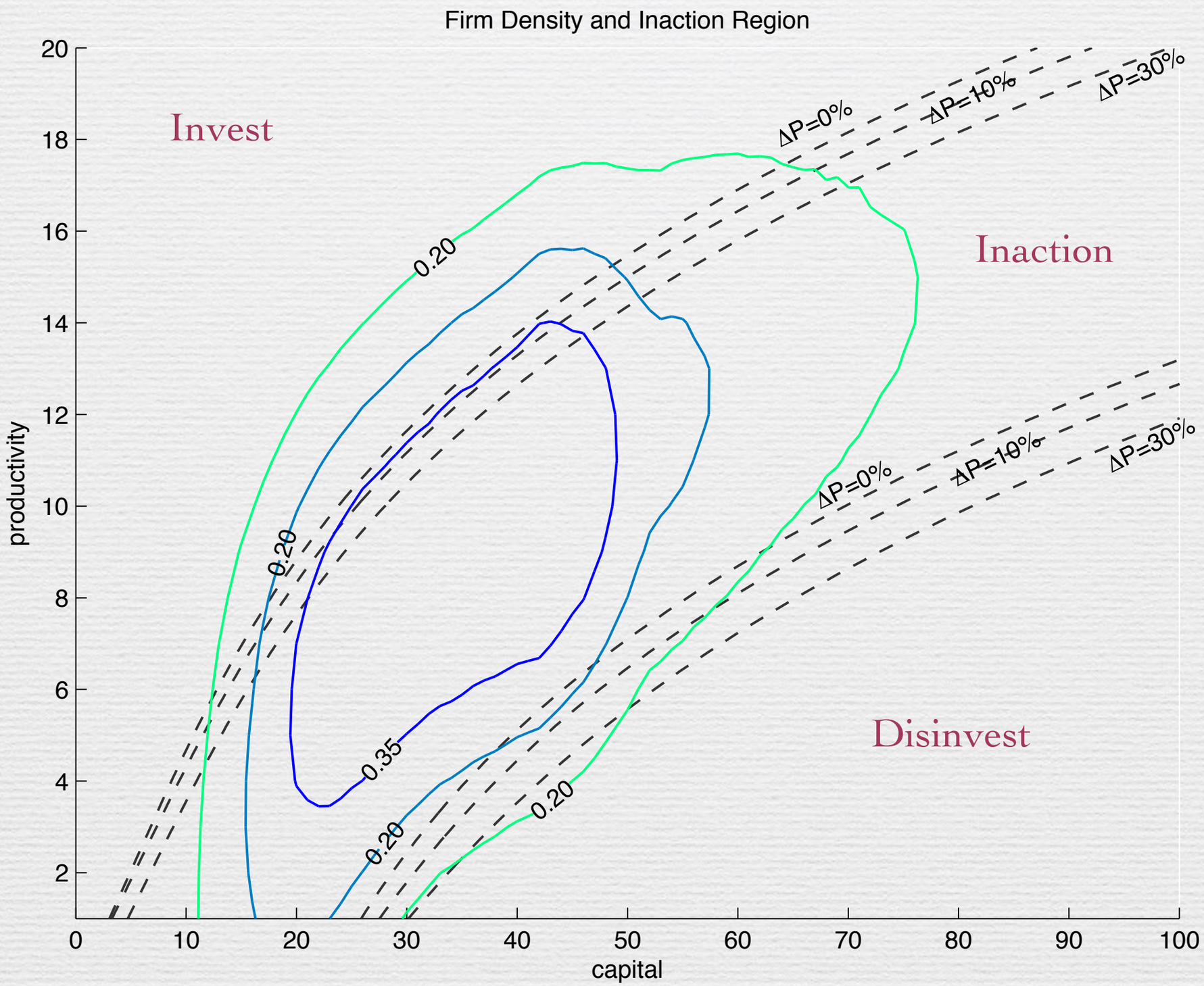
Simulation

- Increase in export opportunities: Increase in international prices (small country)
- Permanent one time 10% increase in the Food sector price (sector 1)
- Use estimated structural parameters for the solution.
- Find the equilibria for the transition after the shock, and the new steady state

Export Sector Adjustment

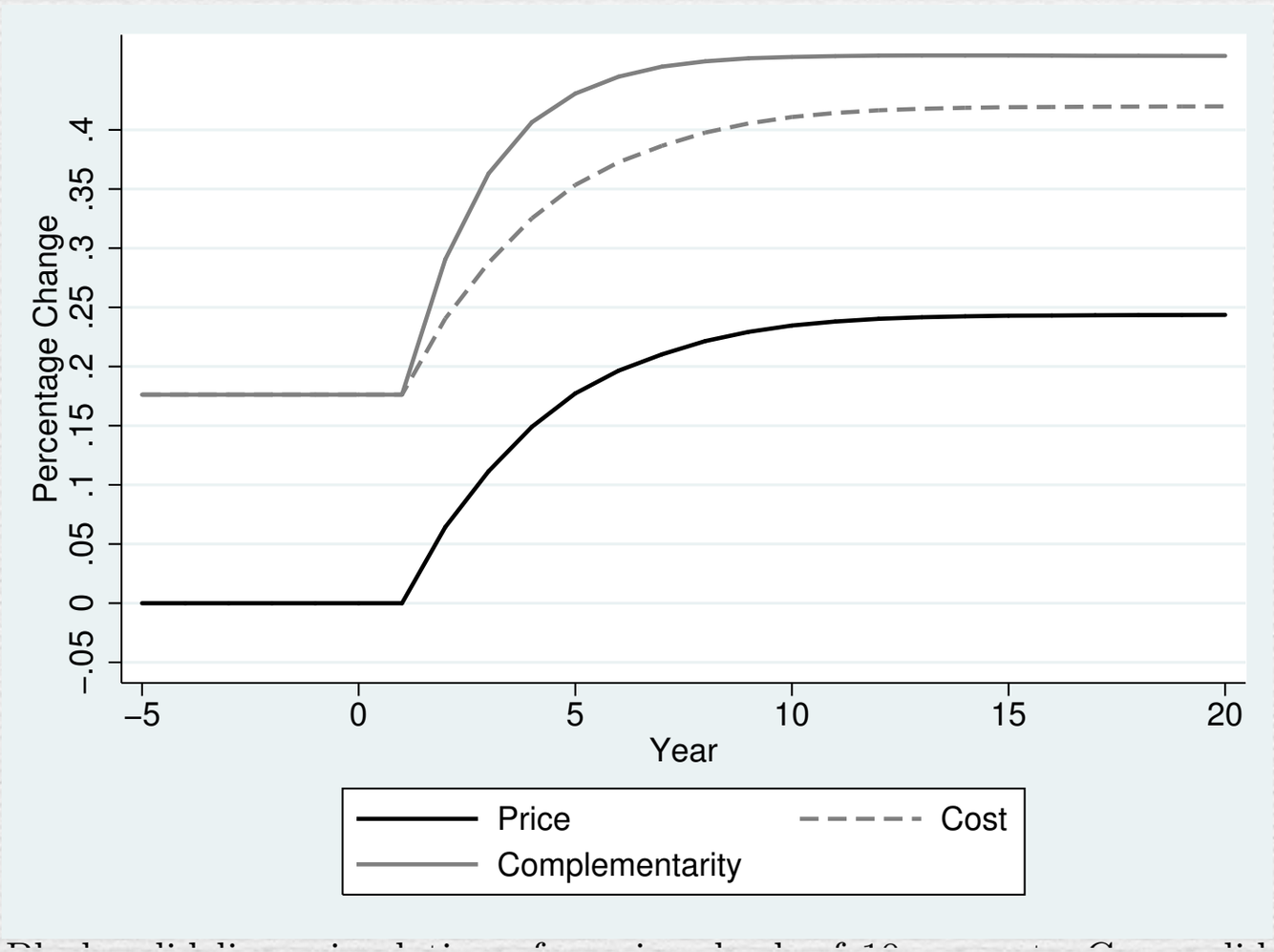


Firm Density and Inaction



Simulation: Complementarity

- Simulate a 10% price increase (trade) shock with a reduced cost structure, and calculate the response of capital, employment, wage, output, etc.



Decompose the Response:

- Response to higher price
- Response to lower cost
- Response to both (only)

Complementarity of Trade Shocks and Capital Adjustment Costs

	Year 2	Year 3	Year 5	Steady State	Years to Convergence
A) Response of Aggregate Capital Stock					
Total response	29.06	36.32	43.07	46.23	6
(i) Trade shock	6.43	11.15	17.73	24.38	10
(ii) Cost structure	17.62	17.62	17.62	17.62	–
(iii) Complementarity	5.01	7.54	7.72	4.23	–
Relative complementarity (iii)/(i)	77.90	67.60	43.55	17.33	–
B) Response of Capital Stock Initially Inactive Firms					
Total response	14.50	16.24	17.43	18.15	5
(i) Trade shock	4.26	4.92	5.40	6.24	7
(ii) Cost structure	4.15	4.15	4.15	4.15	–
(iii) Complementarity	6.09	7.17	7.88	7.76	–
Relative complementarity (iii)/(i)	142.94	145.76	145.84	124.25	–
C) Contribution of Initially Inactive Firms to Response of Aggregate Capital Stock					
Total response	38.81	34.80	31.50	30.56	–
(i) Trade shock	51.53	34.32	23.72	19.93	–
(ii) Cost structure	18.32	18.32	18.32	18.32	–
(iii) Complementarity	94.55	74.00	79.43	142.87	–

Complementarity of Trade Shocks and Capital Adjustment Costs

	Year 2	Year 3	Year 5	Steady State	Years to Convergence
A) Employment Food & Beverages					
Total response	15.17	19.72	23.81	25.58	6
(i) Trade shock	7.25	11.51	15.65	17.73	7
(ii) Cost structure	7.42	7.42	7.42	7.42	–
(iii) Complementarity	0.50	0.79	0.74	0.43	–
Relative complementarity (iii)/(i)	6.88	6.90	4.75	2.45	–
B) Output Food & Beverages					
Total response	16.65	20.28	23.58	25.03	6
(i) Trade shock	5.59	8.76	11.84	13.52	7
(ii) Cost structure	10.61	10.61	10.61	10.61	–
(iii) Complementarity	0.45	0.92	1.14	0.90	–
Relative complementarity (iii)/(i)	8.10	10.45	9.60	6.66	–
C) Exports Food & Beverages					
Total response	123.47	140.06	153.49	158.47	5
(i) Trade shock	68.01	81.14	96.38	103.57	6
(ii) Cost structure	50.98	50.98	50.98	50.98	–
(iii) Complementarity	4.49	7.95	6.14	3.92	–
Relative complementarity (iii)/(i)	6.60	9.79	6.37	3.79	–
D) Wages Food & Beverages					
Total response	6.73	5.47	4.36	3.89	7
(i) Trade shock	4.42	2.96	1.92	1.51	8
(ii) Cost structure	2.19	2.19	2.19	2.19	–
(iii) Complementarity	0.12	0.31	0.25	0.19	–
Relative complementarity (iii)/(i)	2.65	10.62	12.84	12.90	–

Complementarity of Trade Shocks, Capital and Labor Adjustment Costs

	Year 2	Year 3	Year 5	Steady State	Years to Convergence
A) Employment Food & Beverages					
Total response	17.78	23.03	26.62	27.19	5
(i) Trade shock	7.25	11.51	15.65	17.73	7
(ii) Cost structure	7.13	7.12	7.12	7.14	–
(iii) Complementarity	3.40	4.40	3.85	2.32	–
Relative complementarity (iii)/(i)	46.91	38.24	24.63	13.10	–
B) Output Food & Beverages					
Total response	18.26	22.45	25.53	26.14	5
(i) Trade shock	5.59	8.76	11.84	13.52	7
(ii) Cost structure	10.40	10.39	10.39	10.41	–
(iii) Complementarity	2.27	3.30	3.30	2.21	–
Relative complementarity (iii)/(i)	40.54	37.63	27.89	16.32	–
C) Exports Food & Beverages					
Total response	163.93	183.43	195.42	196.06	4
(i) Trade shock	68.01	81.14	96.38	103.57	6
(ii) Cost structure	84.30	84.12	84.09	84.37	–
(iii) Complementarity	11.62	18.17	14.95	8.12	–
Relative complementarity (iii)/(i)	17.09	22.40	15.51	7.84	–
D) Wages Food & Beverages					
Total response	8.41	7.01	6.11	5.98	5
(i) Trade shock	4.42	2.96	1.92	1.51	8
(ii) Cost structure	4.88	4.87	4.87	4.87	–
(iii) Complementarity	-0.90	-0.82	-0.68	-0.40	–
Relative complementarity (iii)/(i)	-20.29	-27.79	-35.51	-26.35	–

Conclusion

- The speed of adjustment after trade shocks depends on capital and labor adjustment costs
- Workers' and firms' adjustment processes interact, and crucially depend on each other
- The effect of a positive trade shock is larger, if capital and labor frictions are reduced simultaneously